manner that the gain for lower frequencies is increased relative to the gain for higher frequencies. Conversely, receipt of an indication of a reduced amount of bass may cause the filter to be determined in a manner that reduces the gain for lower frequencies relative to the gain provided for higher frequencies.

[0046] As described above, the audio performance of a filter may be determined in terms of the first and second principal components. These principal components may, in turn, be represented by a difference X and sum Y of the principal components with the difference X and sum Y thereafter being combined as a result of a linear relationship therebetween so as to be represented as G=X+bY, which defines the audio performance of the filter. In the foregoing equation, G represents the frequency response of the filter including, for example, a shelving filter and a high pass/low pass filter. Thus, the gain of the filter may be determined in accordance with an example embodiment as G=X+bY over a range of frequencies. The filter may be determined by combining the frequency responses of the principal components with the factor b being defined so that the best fit, that is, the best correlation, may be found between the line and the measured values of X and Y, such as shown in FIGS. **3**A and **3**B. As described above, the values for X, Y and b vary depending upon the size of the pair of headphones. Thus, receipt of the indication of the size of the pair of headphones may, in turn, define the values of X, Y and b since different sets of values for X, Y and b may be predefined for large headphones and for small headphones.

[0047] As such, the size of the headphones and the gain for a respective frequency band, such as the balance between high and low frequencies, e.g., the amount of bass, may cause the filter to be determined such that audio signals may be subsequently filtered and output by the pair of headphones in order to provide audio signals having the desired audio qualities. By only requiring input from the user in regards to the size of the headphones and the gain for a respective frequency band, such as the balance between high and low frequencies, e.g., the amount of bass, the user is able to provide the requisite input in an intuitive manner for parameters that are relatively comprehensible, while the resulting quality of the audio signals is tailored for the size of headphones and the user's desired gain for the respective frequency band of interest. Thus, the quality of the audio signals output by the pair of headphones is enhanced with only minimal input from the listener.

[0048] In terms of the balance, it is noted that as a result of the headphone acoustics and the signal processing chain, the sound will have a balance (or unbalance) between high and low frequencies. The user, however, may prefer a different relation between different frequency bands than that otherwise produced by the current combination of the headphone acoustics and the signal processing chain. As such, the method, apparatus and computer program product of an example embodiment permit the user to adjust the relation or balance between the different frequency bands. Typically, however, users prefer the sound to have relatively equal amounts of high and low frequencies, hence a balance between high and low frequencies. By adjustment of the gain, a user may establish the desired balance between the high and low frequencies, whether equal or not. For example, in some embodiments, the user may adjust the gain such that the resulting filter more greatly modifies the gain associated with signals having a low frequency than those signals having a high frequency, for which the gain is not modified or is only modified minimally relative to the modification of the low frequency signals.

[0049] A pair of headphones generally has a left channel and a right channel directed to the left and right headphones, respectively. As such, the method, apparatus and computer program product of an example embodiment may determine a filter, including the shape and gain information, for one of the channels and then replicate the same filter for the other channel. Alternatively, the method, apparatus and computer program product of another embodiment may separately determine a filter for each of the left and right channels.

[0050] As described above, FIG. **6** illustrates a flowchart of an apparatus **30**, method and computer program product according to example embodiments of the invention. It will be understood that each block of the flowchart, and combinations of blocks in the flowchart, may be implemented by various means, such as hardware, firmware, processor, circuitry, and/or other communication devices associated with execution of software including one or more computer program instructions. For example, one or more of the procedures described above may be embodied by computer program instructions. In this regard, the computer program instructions which embody the procedures described above may be stored by a memory device **34** of an apparatus employing an embodiment of the present invention and executed by a processor **32** of the apparatus. As will be appreciated, any such computer program instructions may be loaded onto a computer or other programmable apparatus (e.g., hardware) to produce a machine, such that the resulting computer or other programmable apparatus implements the functions specified in the flowchart blocks. These computer program instructions may also be stored in a computer-readable memory that may direct a computer or other programmable apparatus to function in a particular manner, such that the instructions stored in the computer-readable memory produce an article of manufacture the execution of which implements the function specified in the flowchart blocks. The computer program instructions may also be loaded onto a computer or other programmable apparatus to cause a series of operations to be performed on the computer or other programmable apparatus to produce a computer-implemented process such that the instructions which execute on the computer or other programmable apparatus provide operations for implementing the functions specified in the flowchart blocks.

[0051] Accordingly, blocks of the flowchart support combinations of means for performing the specified functions and combinations of operations for performing the specified functions for performing the specified functions. It will also be understood that one or more blocks of the flowchart, and combinations of blocks in the flowchart, can be implemented by special purpose hardware-based computer systems which perform the specified functions, or combinations of special purpose hardware and computer instructions.

[0052] In some embodiments, certain ones of the operations above may be modified or further amplified. Furthermore, in some embodiments, additional optional operations may be included. Modifications, additions, or amplifications to the operations above may be performed in any order and in any combination.

[0053] Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of